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**C20-C-CM-102****7017****BOARD DIPLOMA EXAMINATION, (C-20)****SEPTEMBER/OCTOBER—2021****DAE - FIRST YEAR EXAMINATION****ENGINEERING MATHEMATICS - I***Time : 3 hours ]**[ Total Marks : 80***PART—A**

3×10=30

- Instructions :** (1) Answer **all** questions.  
(2) Each question carries **three** marks.

1. Find the domain and range of  $f$  if  $f: A \rightarrow B$  defined by  
 $f = \{(-3, 1), (-1, 1), (1, 0), (3, 0)\}$

2. Resolve  $\frac{x+1}{x^2+5x+6}$  into partial fractions.

3. If  $A = \begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$ , find  $AB$ .

4. Show that  $\frac{\cos 37^\circ + \sin 37^\circ}{\cos 37^\circ - \sin 37^\circ} = \cot 8^\circ$

5. Prove that  $\frac{\sin 2A}{1 - \cos 2A} = \cot A$

6. Find the multiplicative inverse of the complex number  $4 - 3i$ .
7. Find the equation of the line passing through the points  $(1, -2)$ ,  $(-2, 3)$ .
8. Evaluate  $\lim_{x \rightarrow 0} \frac{\sin 9x}{\sin 6x}$
9. Differentiate  $\frac{1 + e^x}{1 - e^x}$
10. If  $x = a \cos \theta$  and  $y = a \sin \theta$ , then find  $\frac{dy}{dx}$ .

### PART—B

8×5=40

**Instructions :** (1) Answer **all** questions.  
(2) Each question carries **eight** marks.

11. (a) Show that  $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$

**OR**

(b) Solve the following equations by Cramer's Rule.

$$x + 2y + 3z = 6, 2x + 4y + z = 7 \text{ and } 3x + 2y + 3z = 8$$

12. (a) Show that  $\sin^2 A + \sin^2 (60 + A) + \sin^2 (60 - A) = \frac{3}{2}$

**OR**

(b) If  $\tan^{-1}(x) + \tan^{-1}(y) + \tan^{-1}(z) = \frac{\pi}{2}$ , then show that  $xy + yz + zx = 1$ .

13. (a) Solve :  $\sin x + \cos x = \sqrt{2}$

OR

(b) In any  $\Delta ABC$ , if  $a \cos A = b \cos B$ , prove that  $\Delta ABC$  is either isosceles or right angled.

14. (a) Find the equation of the parabola whose focus is the point  $(3, -4)$  and directrix is the line  $x - y + 5 = 0$ .

OR

(b) Find the centre, vertices, lengths of axes, length of latus-rectum, eccentricity, foci and the equations of the latus-recta and directrices of the ellipse  $4x^2 + 9y^2 = 36$ .

15. (a) If  $x^y = e^{x-y}$ , then prove that  $\frac{dy}{dx} = \frac{\log x}{(1 + \log x)^2}$  using logarithmic differentiation.

OR

(b) If  $y = \sqrt{\cos x + \sqrt{\cos x + \sqrt{\cos x + \dots \infty}}}$ , then find  $\frac{dy}{dx}$ .

### PART—C

10×1=10

**Instructions:** (1) Answer the following question.

(2) Its carries **ten** marks.

16. Find the length of the tangent, normal, subtangent and subnormal to the curve  $y = x^3 - 3x + 2$  at  $(0, 2)$ .

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